

WHAT IS CLAIMED IS:

1. A file replication method for creating, in a distributed file system including a plurality of network storage apparatus and a replication system each connected to a network wherein  
5 the replication system has a management table for managing attribute information of all files and directories in the network storage apparatus as a replication source, a partial copy of data stored in the network storage apparatus as the replication source in the network storage apparatus as a replication  
10 destination, said method comprising the steps of:

preliminarily recording replication information for specifying a file as a target of replication in said replication system;

receiving a file access request from a client;

15 judging whether or not a replicating operation should be performed with execution of said file access request by using said management table and said replication information; and

simultaneously transferring, if a result of said judgment is such that the replicating operation should be performed,  
20 said file access request to said network storage apparatus as the replication source and to said network storage apparatus as the replication destination.

2. A file replication method according to claim 1, wherein said replication system contains synchronization information  
25 indicative of whether or not contents of a file and a directory,

each as an object to be copied, maintain consistency between the network storage apparatus as the replication source and the network storage apparatus as the replication destination and judges that the replicating operation should be performed  
5 under a condition that said synchronization information indicates consistency in said judgment step.

3. A file replication method according to claim 1, wherein the judgment is performed in said judgment step that the replicating operation should be performed under a condition  
10 that the received file access request is a write request.

4. A replication system for performing file replication between a plurality of network storage apparatus connected to a network, said replication system comprising:

a management table for managing attribute information  
15 of all files and directories in the network storage apparatus as a replication source;

a unit for holding replication information indicative of whether or not replication should be performed;

a request reception unit for receiving, a file access  
20 request from a client; and

a replication unit for simultaneously transferring the file access request to the plurality of network storage apparatus, said replication unit including

a judgment unit for judging whether or not replication  
25 should be performed by using the management table and the

replication information and

a request processing unit for simultaneously transferring,  
in accordance with a result of the judgment, the file access  
request to the network storage apparatus as the replication  
5 source and to the network storage apparatus as a replication  
destination.

5. A replication system according to claim 4, wherein  
said replication unit further includes a consistency unit for  
maintaining consistency of all files and directories, each as  
10 an object to be copied, between the network storage apparatus  
as the replication source and the network storage apparatus  
as the replication destination.

6. A replication system according to claim 4, wherein  
said judgment unit judges that replication should be performed  
15 if the received file access request is a write request.

7. A replication system according to claim 4, further  
having a unit for holding synchronization information  
indicating that contents of a file and a directory, each as  
an object to be copied, maintain consistency between the network  
20 storage apparatus as the replication source and the network  
storage apparatus as the replication destination and said  
judgment unit judges whether or not replication should be  
performed by also using the synchronization information.

8. A replication system according to claim 4, wherein  
25 said replication information is at least one rule indicating

that a file having a specified user or group identifier, a file belonging to a specified directory, or a file having a specified file identifier is an object to be copied.

9. A file replication method for creating, in an external  
5 network storage, a partial copy of data stored in a  
virtualized-and-unified file system including a plurality of  
network storages and a unification virtualizing system for  
managing, in a unified manner, a structure of files and  
directories present in distributed relation in the network  
10 storages and attribute information thereof and allowing a  
unified access to the network storages from an outside, said  
method comprising the steps of:

preliminarily recording, in said unification  
virtualizing system, replication information specifying the  
15 file as a target of replication;

receiving, in a unified manner, a file access request  
from a client to said virtualized-and-unified file system;

specifying the network storage storing therein the file  
as a target of said file access request by using a mapping unit  
20 for determining and setting the network storage for each of  
the files;

judging, by using said replication information, whether  
or not a replicating operation should be performed with execution  
of said file access request; and

25 transferring said file access request to the specified

network storage and, if a result of said judgment is such that the replicating operation should be performed, transferring the file access request also to the external network storage as a replication destination, and thereby causing each of the  
5 network storage storing therein said target file and the external network storage as the replication destination to execute a file access requested by the file access request.

10. A file replication method according to claim 9, wherein it is judged in said judgment step that the replicating operation  
10 should be performed under a condition that the received file access request is a write request.

11. A file replication method according to claim 9, said method further comprising the step of:

collecting a response to the file access request from  
15 said network storage device storing therein said file and a response to the file access request from said network storage as the replication destination and returning the collected responses as one response to said client.

12. A unification virtualizing system for a plurality  
20 of network storages, said system virtually showing the plurality of network storages connected to a network as a single file system and comprising:

a unified management directory for managing a structure  
of all files and directories present in said  
25 virtualized-and-unified file system and attribute information

thereof;

a unit for holding replication information for specifying the file to be replicated by assuming that an external file system is a replication destination;

5 a request reception unit for receiving a file access request from a client;

a mapping unit for determining the network storage of a file access target of said file access request;

a judgment unit for judging whether or not the file access  
10 target of said file access request should be replicated in said external file system by using the unified management directory and the replication information; and

a request transfer unit for simultaneously transferring, if the judgment unit judges that replication should be performed,  
15 said file access request to the external file system as the replication destination and to the network storage determined by the mapping unit.

13. A unification virtualizing system for a plurality of network storages according to claim 12, further comprising:

20 a consistency unit for maintaining consistency of a file and an directory, each as an object to be copied, between said virtualized-and-unified file system and said external file system as the replication destination.

14. A unification virtualizing system for a plurality  
25 of network storages according to claim 12, further comprising:

a response collection unit for collecting a response to the file access request from each of the network storages belonging to said virtualized-and-unified file system and a response to the file access request from said external file system as the replication destination and returning the collected responses as one response to the client.

15. A unification virtualizing system for a plurality of network storages according to claim 12, further comprising:

a unit for holding synchronization information indicating that all files and directories, each as an object to be copied, maintain consistency between said virtualized-and-unified file system and said file system as the replication destination, wherein

said judgment unit judges whether or not replication should be performed by also using the synchronization information.

16. A unification virtualizing system for a plurality of network storages according to claim 12, wherein said judgment unit judges that replication should not be performed if the file access request is a read request and the file access request is not transferred to the external file system as the replication destination.

17. A unification virtualizing system for a plurality of network storages according to claim 12, wherein said replication information is at least one rule indicating that

a file having a specified user or group identifier, a file subordinate to a specified directory, or a file having a specified file identifier is an object to be copied.

18. A unification virtualizing system for a plurality  
5 of network storages according to claim 12, further comprising:

a unit for holding master information indicating that the files and directories managed by the unified management directory are masters, wherein

said judgment unit judges whether or not replication  
10 should be performed in accordance also with the master information.

19. A unification virtualizing system for a plurality of network storages according to claim 17, wherein said replication information includes not only the rule but also  
15 information for identifying the virtualized-and-unified file system to which the rule is applied.

20. A virtualized-and-unified file system comprised of a plurality of network storages and a unification virtualizing system, wherein

20 the unification virtualizing system has a replication unit, said virtualized-and-unified file system including:

a plurality of virtualized-and-unified file systems, of which a first virtualized-and-unified file system responds to an access request from a client, activates the replication unit,  
25 and creates in real time a partial copy of the first



virtualized-and-unified file system in another virtualized-and-unified file system connected to a network.

21. A virtualized-and-unified file system connected to a network and comprised of a plurality of network storages and  
5 a unification virtualizing system, wherein

the unification virtualizing system has a replication unit, said virtualized-and-unified file system including:

a plurality of virtualized-and-unified file systems, of which a first virtualized-and-unified file system responds to  
10 an access request from a client, activates the replication unit, and creates in real time a partial copy of the first virtualized-and-unified file system in another network storage connected to the network.

22. A unification virtualizing system for a plurality  
15 of network storages according to claim 12, further comprising:

a capacity management unit for periodically acquiring respective disk capacities and amounts of disk use of said virtualized-and-unified file system and said external file system as the replication destination and determining, from  
20 said disk capacities and amounts of disk use, a disk capacity and an amount of disk use which allow for replication.